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Energy Centre Summer School

Hedging risk for generators/retailers

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Trustpower

- 218,000 electricity customers
- 31,000 gas customers
- 56,000 telco customers
- 38 hydro generation stations
- Evolved from the Tauranga Electric Power Board
- Listed on the NZSX in 1994
- Sold lines business in 1998
- Demerged Australian Wind Assets in 2016
- Majority owned by Infratil (51.1%) & TECT (26.8%)
- 800 employees

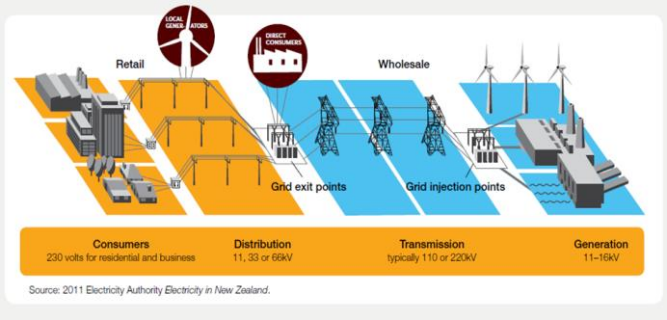
Who am I?

- 2003-2009 Energy Market Analyst/Trader (NZ)
- 2009-2011 Cross Boarder Power Trader (De)
  - Trading Power and capacity across Europe
- 2011-2012 Proprietary Trader (De)
  - UK Power, Gas and Carbon Trading
- 2012 - Trustpower
  - Managing Trustpowers commodity risk

Many risks we face

- Manageable
  - Price risk (the focus of today)
  - Volume risk (with exotic instruments)
- Unmanageable
  - Political (significant changes to market structure)
  - Third Party actions (Tiwai Exit)
  - …

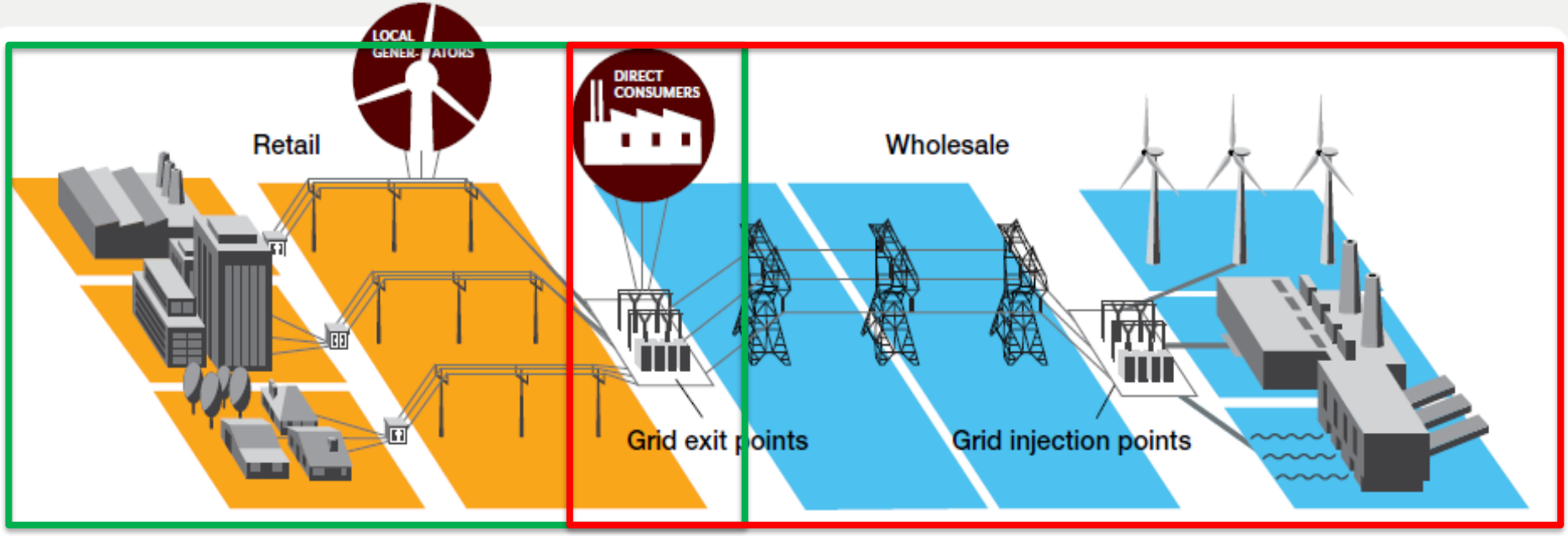
Outline



1. Review role of “spot market”
2. Explain retailer/generator interactions with spot market
3. Show how “spot risk” arises
4. What is a hedge?
5. Show how hedges can reduce spot risk
6. Conclusions and questions

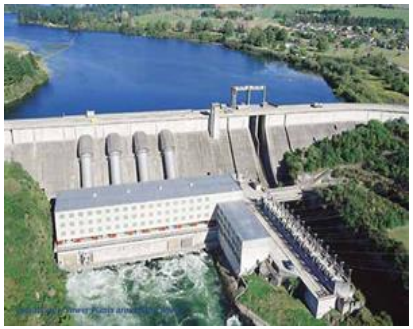
The Spot Market(s)

Retail (= "fixed price") market **Wholesale (= "spot price") market**



Source: 2011 Electricity Authority *Electricity in New Zealand*.

Role of the wholesale (spot) market



The primary role of the wholesale market is to work out which power stations to run, when, to keep the lights on

Spot Pricing Engine – “SPD”

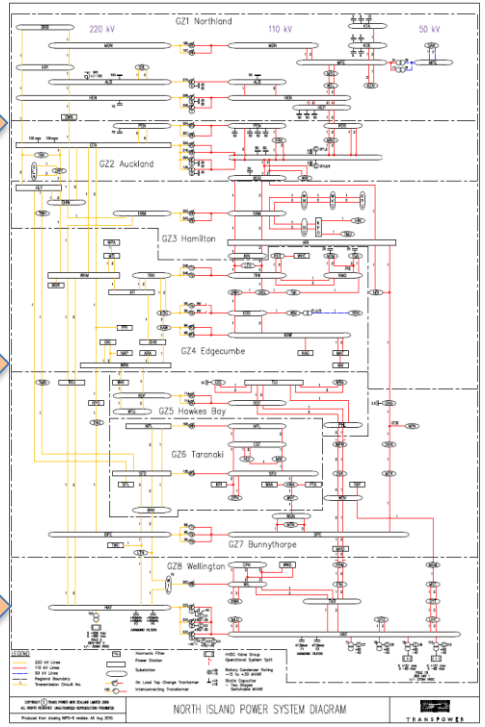
TRANSPOWER

Auction / Pricing System

Generators offering to sell (MW)

Estimated consumer demand (MW)

National Grid Rules and Capacities



Cheapest solution

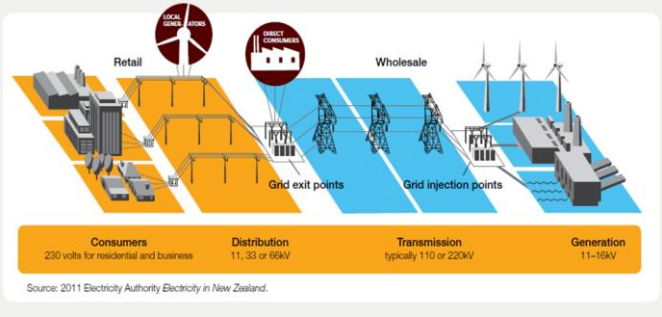
Instructions to generators (on / off)

Wholesale price ($/MWh)

Varies by half hour and by location
Paid TO generators
Paid BY retailers

Role of the wholesale (spot) market

1. Maintain supply / demand balance (keep lights on)
2. Use most efficient (lowest cost) generation first
3. Set correct price at 270+ nodes x 48 half-hour periods / day
4. Facilitate “Gross Pool” market payments
   - all generators sell into spot market (receive spot price)
   - all retailers buy out of spot market (pay spot price)

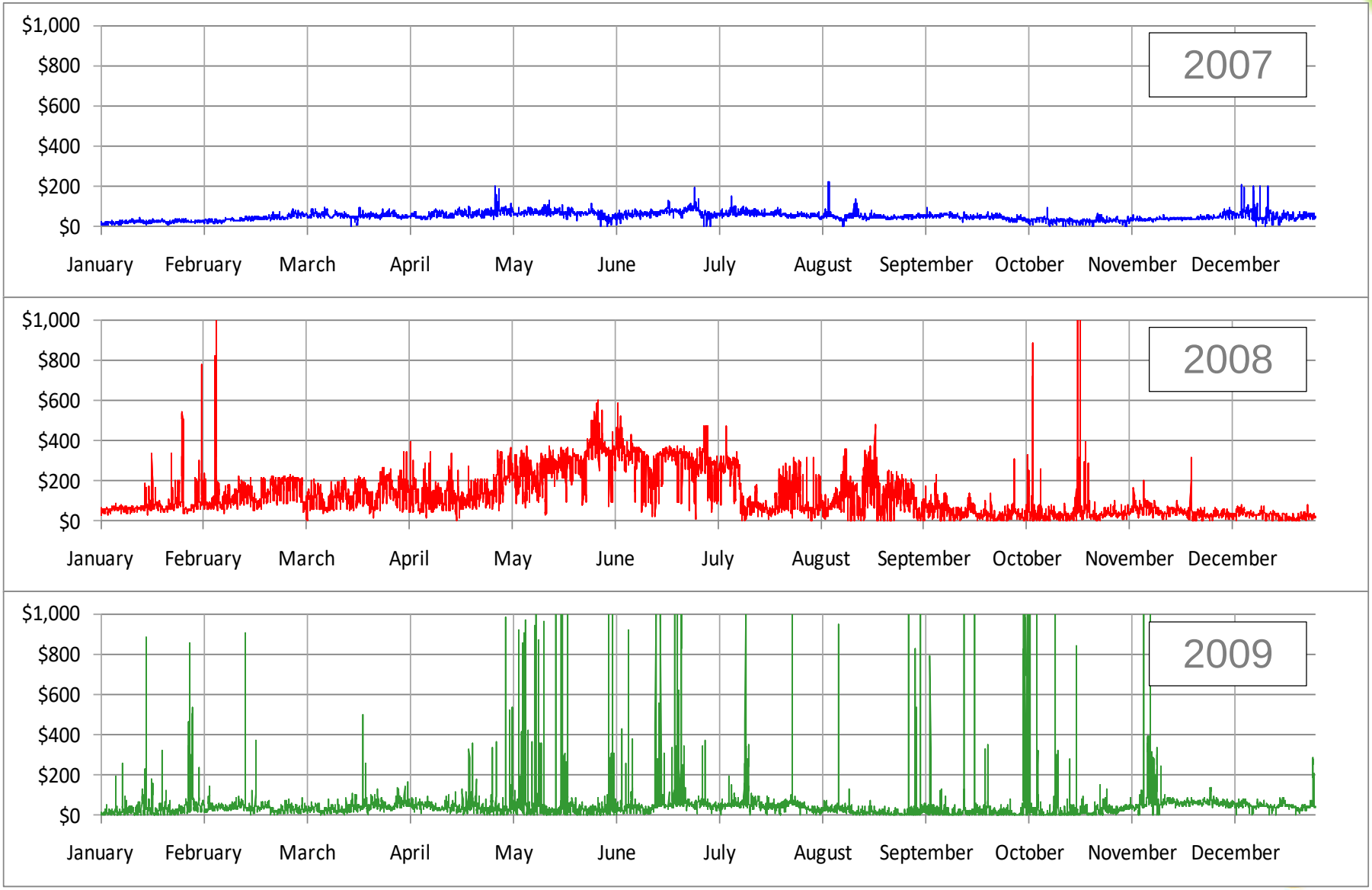


Market(s) : Wholesale versus Retail prices

	$/MWh	c/kWh
Wholesale electricity (spot, volatile)	70-80 avg Could be $10K + !	7-8
Risk markup	↓	↓
Retail electricity cost (fixed each year)	100	10
Other charges (transmission, distribution, levies, metering, profit, GST etc)		12 - 20
Delivered rate to customer		22-30

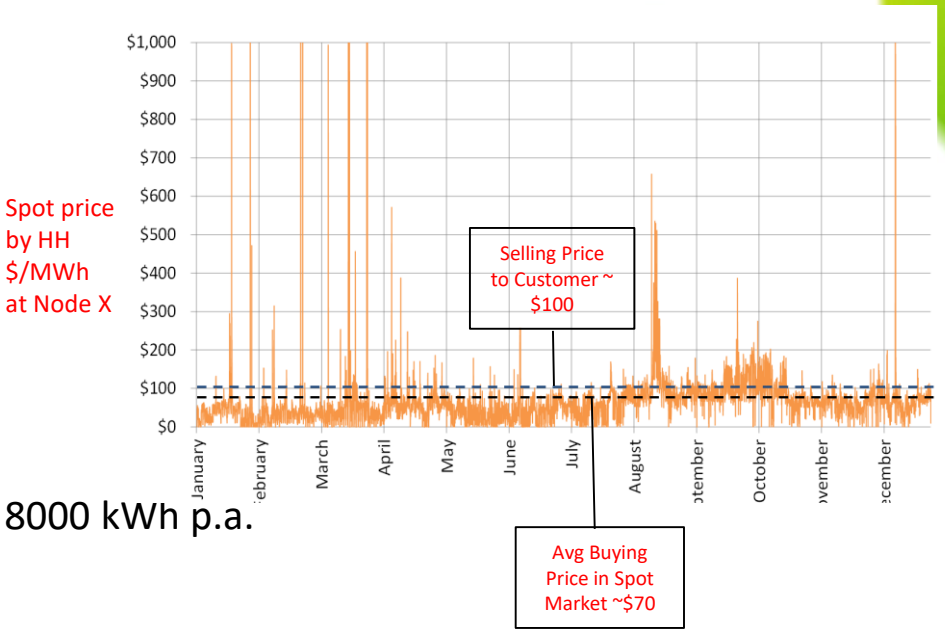
Customer is protected against spot price volatility

Spot Prices can be volatile : yearly



Retailer example

Sales bring "spot risk"



eg Retailer A acquires 1000 customers, each using 8000 kWh p.a.
= approx 1 MW of load (on average),

and sells to customer at fixed price, (say) 10c/kWh energy = $100/MWh

must buy load from spot market via Clearing Manager (Pool), expect a cost of around $70/MWh (on average)

expected "profit" = $30/MWh = $20 per customer per month = $240 pa per customer

But how do you manage the "spot risk" ?
eg spot market reaches $300/MWh, lose $144k / month = loss of $144 per customer per month

(1 MW x 24 hrs x 30 days x ($100 - $300)) = loss of $144K total per month

Hedging

- Retailer buying (or Generator selling) at fixed price for a period in the future from another party.
- Reduces exposure to spot market
- Costs may exceed revenues.
- Risk Management can be achieved by “hedging”
- What is a Hedge ?

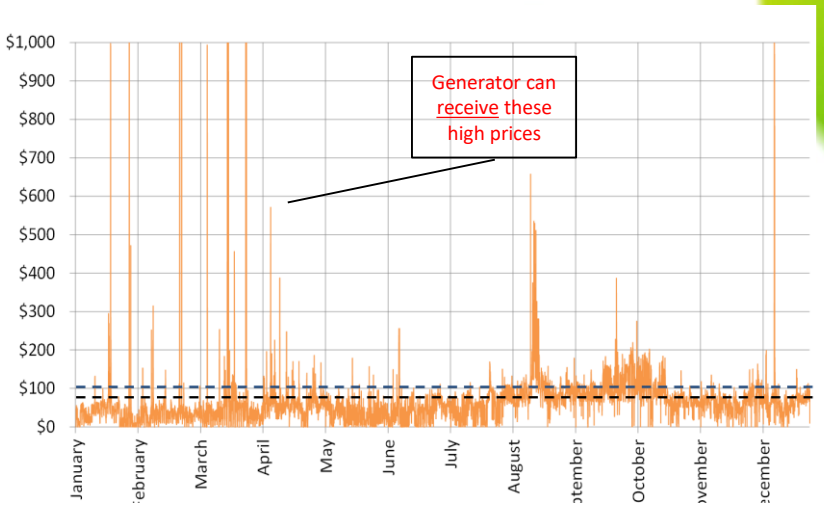
“ investment made to limit loss”

In electricity, hedge types include:

- Physical hedging (eg vertical integration)
- Financial hedging (eg Futures market)

Vertical integration

Portfolio of generation allows lower-risk retailing : how ?



Produce the same quantity (1 MW) of generation

Sell 1 MW generation into spot market, receive the high spot prices, offsetting the high load costs

So Generation has reduced risk for Retail and vice versa.

- Why "vice versa" ?
  - *Because a generator without retail faces the risk of LOW spot prices*
  - *So with retail, the generator now has a hedge provided by customers paying a fixed price*
- Does the retailer have to own the generator ?
  - *Not necessarily, but must have an arrangement with the generator to be paid the spot price, at least when spot price is above a certain level*
  - *This price level is called the "hedge price" or "strike price".*
  - *If R and G are related parties, = "transfer price".*

Vertical integration example :

Retail Sales + Wind Generator

Spot Market

eg Retailer A acquires 1000 customers
= approx 1 MW of load (on average)

And buys a wind turbine, rated 3 MW, but produces 1 MW on average

Is wind a good "physical hedge" ?
What are the risks ?
How would you hedge those risks ?

Risk Analysis for 'Retail + Wind' Gentailer

Risks
Volume : Timing : Location (V:T:L)

- V : Wind may not produce 1 MW on average
- V : Wind will not respond at all to change in customer load (no "peaking" ability)
- T : Wind may produce 1 MW on average, but at wrong times of day/season
- L : Wind will be sold into spot market at different node (may earn less)

Hedging Possibilities (reducing or offsetting the V:T:L risks)

- V/T : Ask customers to turn off if wind not blowing ???
- V/T : Backup generation – must be reliable, eg diesel generators
- V/T : Wind insurance (pay a premium to receive $ when wind not blowing)
- V/T : Cap instrument (eg pay a premium to receive $ if price goes high)
- T : Battery storage of wind output ? Time shift the generation to match load
- L : Locational hedges eg FTRs (covers nodal location risk)

Summary of Hedging Products in NZ

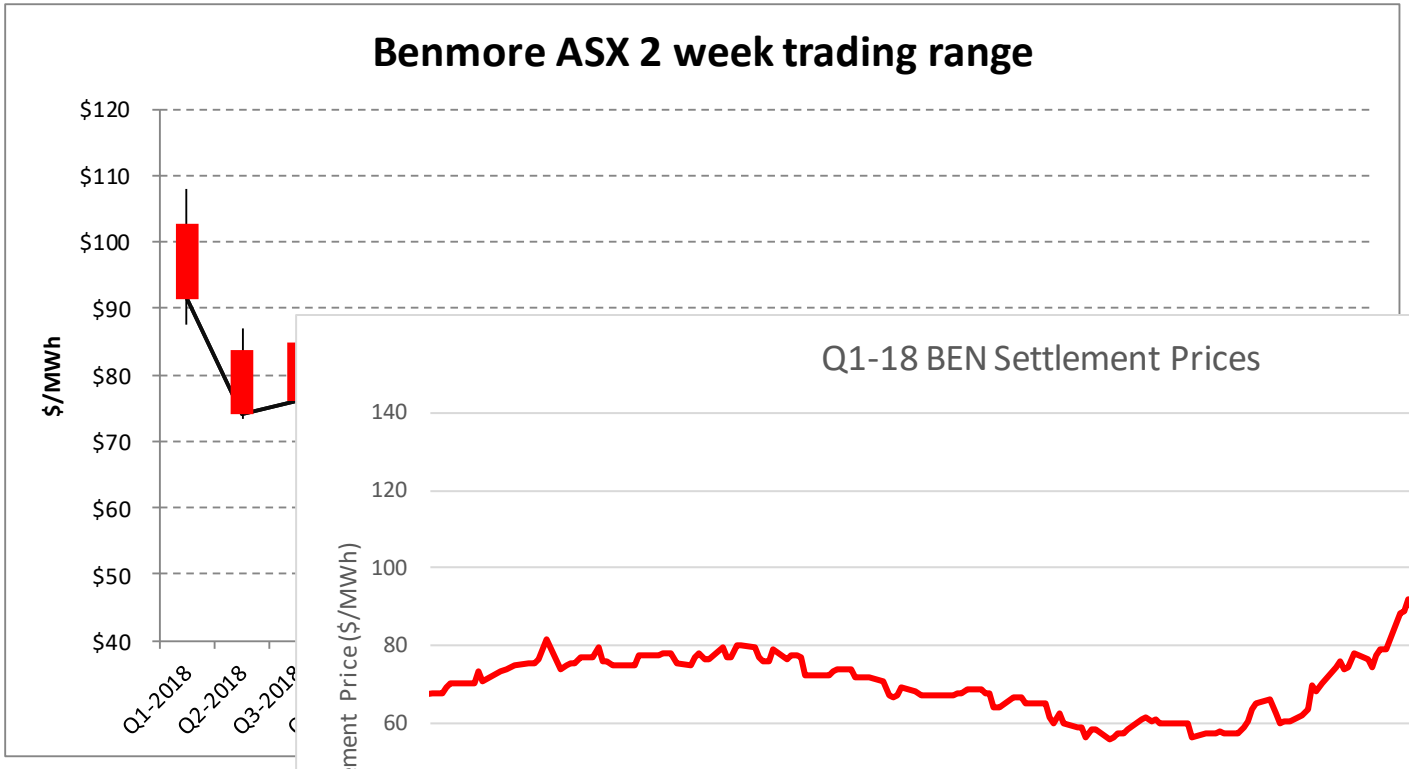
Physical

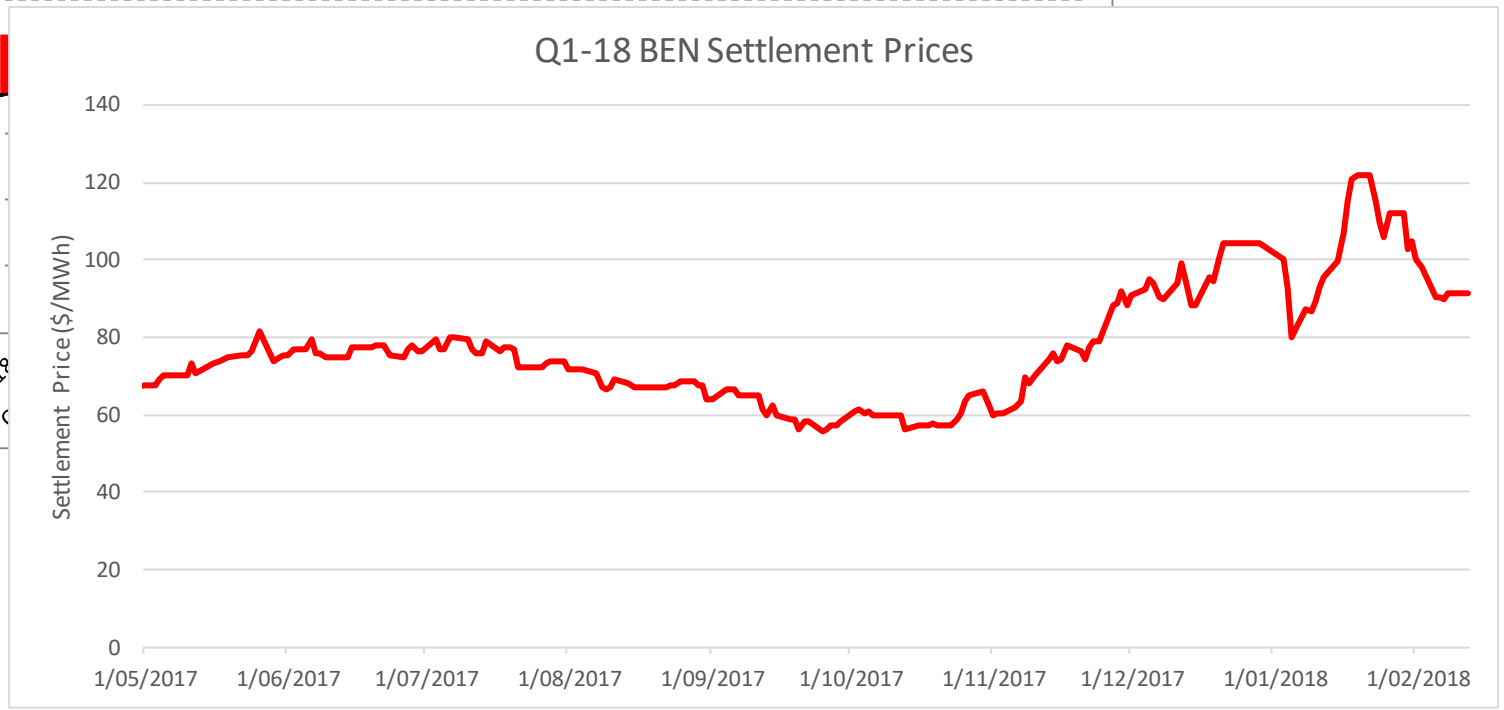
- Vertical integration (own retail + own generation) – such as wind example
- PPAs (Power Purchase Agreements : buy someone else's generation output at a fixed price)

Financial (Derivatives)

- Contracts for Difference (CFDs) : 2 parties are each trading with the spot market, but also enter into a CFD:
  - Buyer of CFD pays hedge price to seller (eg $70/MWh)
  - Seller pays spot price to buyer (could be anything, eg $300/MWh)
  - Settle each month on the difference (eg $230/MWh seller pays buyer). Might be either way.
  - Buyer (retailer) net cost = spot market $300 less CFD $230 = $70
  - Seller (generator) net revenue = spot market $300 less CFD $230 = $70
  - Both buyer and seller are now "hedged at $70". Overall, immune to the spot price.
- Exchange Traded Futures (ETFs), on Australian Securities Exchange (ASX) at Benmore or Otahuhu
  - A gamble on the price for a future period.
  - More liquid than CFDs
- Financial Transmission Rights (FTRs), between Benmore/Otahuhu/Invercargill/Haywards/Islington
- Exotic Instruments : Caps, Options, Swaptions, Weather Insurance, etc (many variations)

“Futures” market hedges (similar to a CFD)





Review

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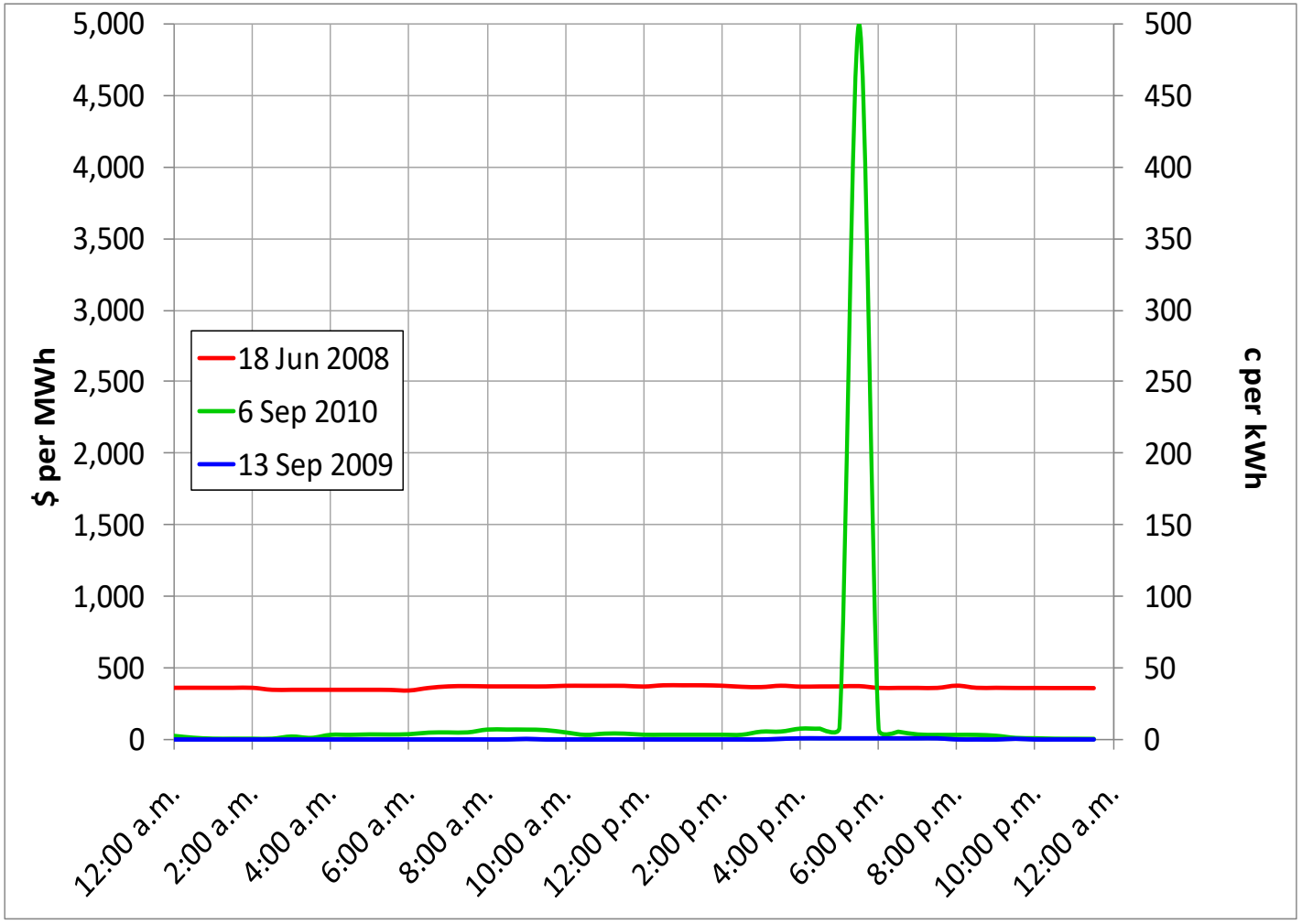
Spot Market

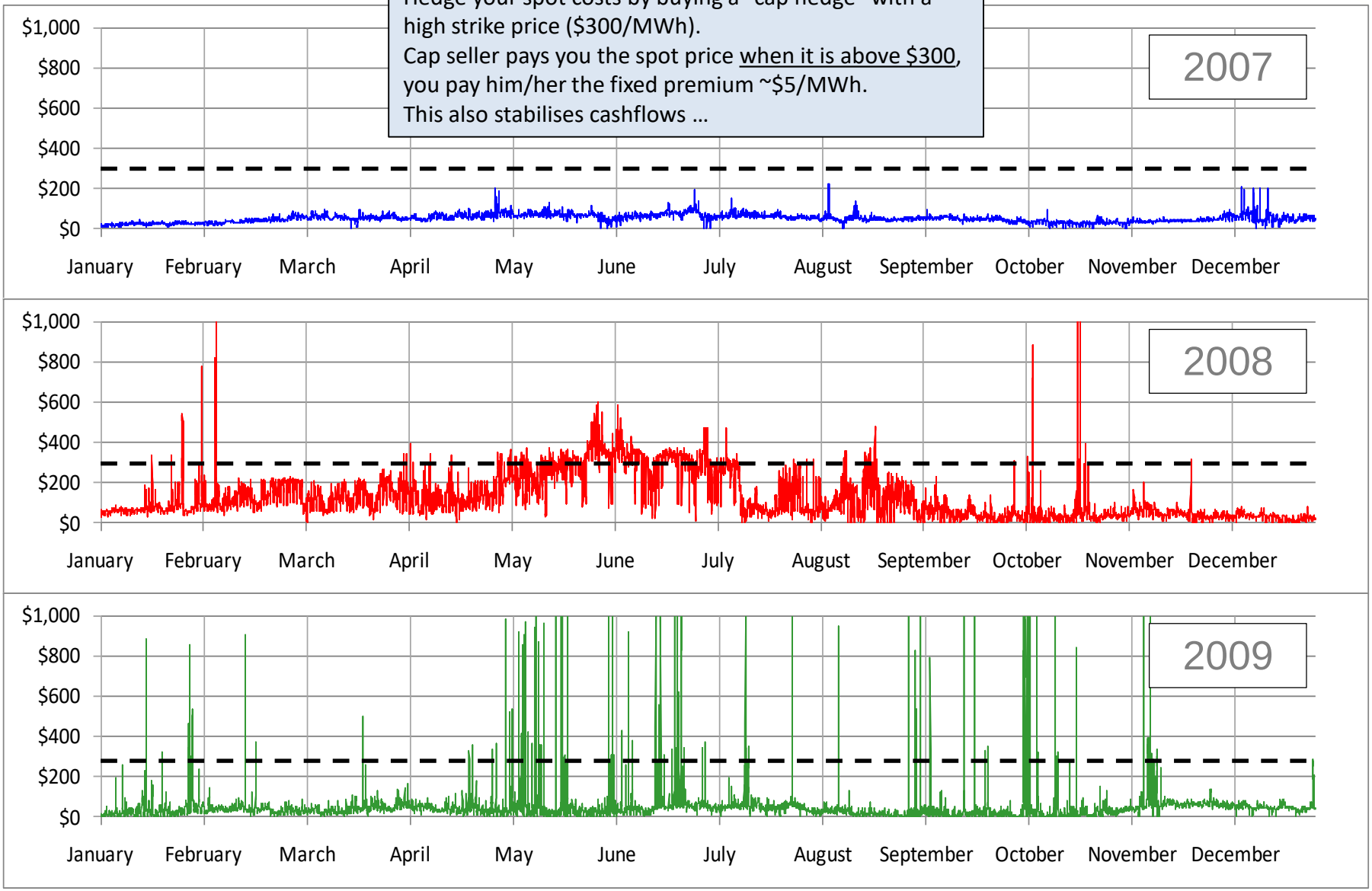
Spare slides

Spot Prices can be volatile : daily

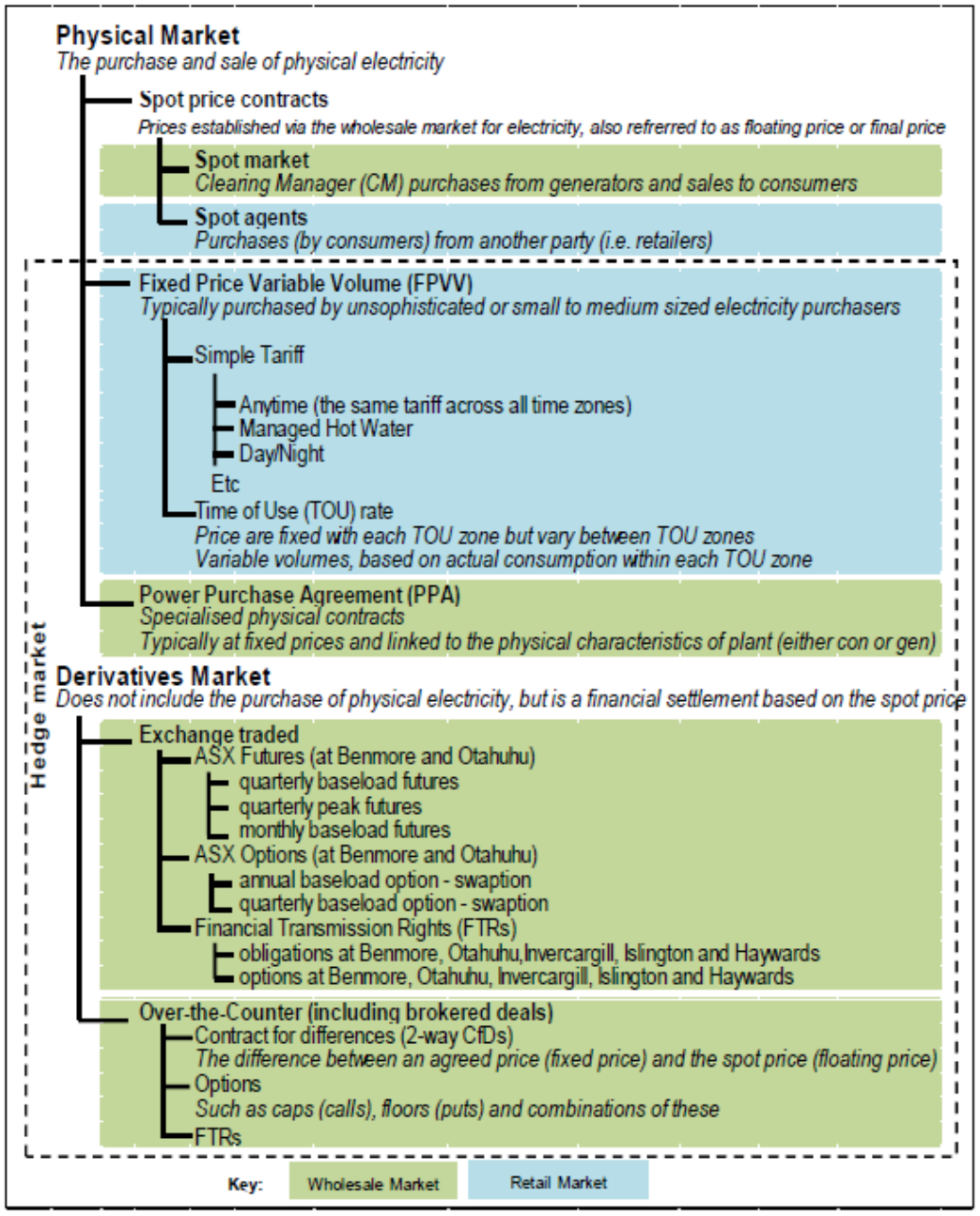


Cap hedging example (like a one-sided CFD)

Hedge your spot costs by buying a "cap hedge" with a high strike price ($300/MWh).
Cap seller pays you the spot price when it is above $300, you pay him/her the fixed premium ~$5/MWh.
This also stabilises cashflows …



View of market instruments



(Source : Electricity Authority Wholesale Advisory Group June 2015)